

Technical Committee Report and Curriculum Guide  
for  
***Food Science and Nutrition***  
**FC 0551**



Idaho Professional Technical Education

*This report was prepared by the  
Idaho Division of Professional-Technical Education  
Family and Consumer Sciences Education  
Boise, Idaho*

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## INTRODUCTION

The Food Science and Nutrition curriculum framework was developed by a team comprised of Idaho Professional-Technical Education staff and Idaho State University personnel. The curriculum team developed the Food Science and Nutrition framework from the National Standards for Family and Consumer Sciences Education, the previous Idaho Food Science and Nutrition guide, Idaho State recommended texts, other states' curricula, and a review of literature pertaining to curriculum content. A committee of selected Idaho teachers participated in the review process.

This statewide curriculum reflects the knowledge and skills recommended for 11th and 12th grade students. Students completing the Food Science and Nutrition course satisfy requirements for a lab science when the course is taught by a Family and Consumer Sciences teacher hold a natural science endorsement. The competency-based curriculum framework format provides the means for monitoring student progress and generating student profiles. The student profile is a cumulative record of student progress and provides documentation of competence.

The Food Science and Nutrition statewide curriculum framework is intended to be the fundamental guide to schools for program content. Schools offering Family and Consumer Sciences education should use an advisory committee to consider local and community needs.

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# FOOD SCIENCE AND NUTRITION

## **COURSE DESCRIPTION**

The focus of this course is on the biology and chemical basis of nutrition, food preparation, preservation, processing, and related consumer topics. Food scientists use scientific methods to conduct lab experiments with food. The preparation of edible food products is not the primary purpose of a food science course, although such products may be the result of experiments performed. Activities and experiments integrate science, mathematics, and language arts. The course provides an option for students to earn a lab science credit for college/university admission when taught by a Family and Consumer Sciences instructor with a Natural Science endorsement. Students with interest/career plans in food science or dietetics will benefit from this course. FCCLA (Family, Career, and Community Leaders of America) leadership activities are an integral part of this course.

## **IMPORTANT INFORMATION**

### **Delivery of the Food Science and Nutrition Curriculum**

Full class participation is emphasized with teamwork as well as individual projects and/or study. The teacher is the facilitator and the manager of the classroom environment. The focus is on laboratory, problem-based instruction that is designed to enable and inspire students to develop higher-level analytical skills.

### **Teacher Qualifications**

The teacher of this course must be certified in Family and Consumer Sciences Education. To provide science credit, the teacher must also hold a secondary Natural Science endorsement. It is highly recommended that teachers have industry experience or a recent internship experience to gain knowledge about career opportunities in family and consumer sciences occupations.

### **Length and Level of this Course**

This course is a one- or two-semester/trimester experience preferably at the 11<sup>th</sup> or 12<sup>th</sup> grade level.

### **Recommended Resources**

Food Science and Nutrition Activity/Resource Guide, 2000

Materials from the current curriculum material list for Family and Consumer Sciences  
FCCLA state and national resource materials

### **Career Pathways**

This course is recommended to students interested in occupations related to nutrition and the scientific study of food. Occupational areas related to the Food Science and Nutrition curriculum are included in the Natural Resources Career Pathways.

CURRICULUM FRAMEWORK PROGRAM AREA: Family and Consumer Sciences

IDAHO DIVISION OF PROFESSIONAL-TECHNICAL EDUCATION

EFFECTIVE DATE: August 2000

PROGRAM TITLE: Food Science and Nutrition I and II

IDAHO CODE NUMBER: 375

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I MAJOR CONCEPTS/CONTENT

Food Science and Nutrition provides students with the opportunity to apply scientific principles and methods with non-threatening chemical substances. Food Science and Nutrition is a year-long course in Family and Consumer Sciences that focuses on the chemical and biological basis of nutrition, food preparation, preservation, and processing in addition to related consumer topics. Activities and experiments integrate science, mathematics, and language arts. Students also develop writing and critical reasoning skills through the process of analyzing and reporting scientific data collected during experiments. The course also explores career and leadership opportunities in food science and nutrition. A lab science credit is earned when the course is taught by a Family and Consumer Sciences instructor who holds a secondary Natural Science endorsement.

II WORK-BASED LEARNING ACTIVITIES

It is recommended that students select a work environment for observation, volunteering or actual work experience depending on available opportunities.

III CONTENT STANDARDS

After successfully completing this course, the student will be able to:

1. **EXPLORE THE WORLD OF FOOD AS A SCIENCE**
2. **EXPLORE CHEMISTRY IN FOOD SCIENCE**
3. **EXPLORE THE APPLICATION OF FOOD SCIENCE**
4. **DEMONSTRATE CHEMICAL PROCESSES INVOLVED IN FOOD PREPARATION**
5. **EXAMINE MICROBIOLOGY IN FOOD PROCESSING**
6. **EXPLORE CAREERS IN FOOD SCIENCE**

<b>SUGGESTED SCOPE AND SEQUENCE</b> <b>Food Science and Nutrition</b>
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- |             |   |    |  |
|-------------|---|----|--|
| 2 – 4 Weeks | ( | 1. | Introduction to Food Science                                 |
|             | ( | A. | What is food science   |
|             | ( | B. | Scientific evaluation  |
|             | ( | 1. | Laboratory equipment   |
|             | ( | 2. | Laboratory safety  |
|             | ( | 3. | Scientific reports   |
|             | ( | C. | Sensory evaluation   |
|             |   |    |  |
|             | ( | 2. | Basic Chemistry for Food Science                             |
|             | ( | A. | The nature of matter   |
|             | ( | 1. | Atoms  |
|             | ( | 2. | Bonding  |
| 3 – 6 Weeks | ( | 3. | Chemical and physical changes                                |
|             | ( | B. | Energy in food   |
|             | ( | 1. | Properties of matter   |
|             | ( | C. | Acids and bases  |
|             | ( | 1. | Ionization of water  |
|             | ( | 2. | Acids and bases  |
|             |   |    |  |
|             | ( | 3. | The Science of nutrition                                     |
|             | ( | A. | Water: The essential element                                 |
|             | ( | 1. | The universal solvent  |
|             | ( | B. | Carbohydrates  |
|             | ( | 1. | Sugars: The simplest carbohydrate                            |
|             | ( | 2. | Starches, cellulose, gums and pectins: Complex carbohydrates |
|             | ( | C. | Lipids   |
|             | ( | 1. | Chemical structure of lipids                                 |
|             | ( | 2. | Functions of lipids  |
|             | ( | 3. | Lipids in the diet   |
| 4 – 8 Weeks | ( | D. | Protein  |
|             | ( | 1. | Structure of protein   |
|             | ( | 2. | Denaturation of protein                                      |
|             | ( | 3. | Functions of protein in food                                 |
|             | ( | 4. | Nutritional contribution of proteins                         |
|             | ( | E. | Vitamins and minerals  |
|             | ( | 1. | Properties of vitamins and minerals                          |
|             | ( | 2. | Functions of vitamins and minerals                           |
|             | ( | 3. | Food sources of vitamins and minerals                        |
|             | ( | 4. | Impact of processing and preservation                        |
|             | ( | F. | Phytochemicals – The other food components                   |
|             | ( | 1. | Health benefits  |
|             | ( | 2. | Food sources   |
|             | ( | G. | Digestion and metabolism                                     |
|             |   |    |  |
|             | ( | 4. | The science of food preparation                              |
|             | ( | A. | Enzymes  |
|             | ( | 1. | Chemical reactions   |
|             | ( | 2. | In food processing   |

- |             |   |    |   |
|-------------|---|----|---|
|             | ( | B. | Mixtures                                  |
|             | ( | 1. | Solutions                                 |
|             | ( | 2. | Colloidal                                 |
|             | ( | 3. | Dispersions                               |
| 3 – 6 Weeks | ( | 4. | Emulsions                                 |
|             | ( | 5. | Suspensions                               |
|             | ( | C. | Leavening agents and baked goods          |
|             | ( | 1. | Chemical leavening agents                 |
|             | ( | 2. | Natural leavening agents                  |
|             | ( | D. | Fermentation and food                     |
|             | ( | 1. | Bacteria fermentation                     |
|             | ( | 2. | Yeast fermentation                        |
|             | ( | 3. | Mold and enzyme fermentation              |
|             | ( | E. | Dairy products and processing             |
|             | ( | 1. | Composition of milk                       |
|             | ( | 2. | Types of milk products                    |
|             | ( | 3. | Cooking with milk                         |
|             | ( | 4. | Fermented milk products                   |
|             | ( | 5. | The science of food processing            |
|             | ( | A. | Food safety                               |
|             | ( | 1. | Micro-organism and food spoilage          |
|             | ( | 2. | Food poisoning                            |
|             | ( | B. | Dehydration                               |
|             | ( | 1. | Purposes of dehydration                   |
|             | ( | 2. | Preparation for dehydration               |
|             | ( | 3. | Method of dehydration                     |
|             | ( | C. | Canning                                   |
|             | ( | 1. | Procedure for canning                     |
| 4 – 8 Weeks | ( | D. | New techniques of food preservation       |
|             | ( | 1. | Freezing                                  |
|             | ( | 2. | Freeze drying                             |
|             | ( | 3. | Irradiation                               |
|             | ( | 4. | Packaging                                 |
|             | ( | E. | Additives and preservatives               |
|             | ( | 1. | Regulating                                |
|             | ( | 2. | Using additives                           |
|             | ( | 3. | Advantages and disadvantages of additives |
|             | ( | F. | Food analogs: Substitute ingredients      |
|             | ( | 1. | Functions of analogs                      |
|             | ( | 2. | Sugar substitutes                         |
|             | ( | 3. | Fat substitutes                           |
|             | ( | 4. | Salt substitutes                          |
|             | ( | 6. | Careers and new technology                |
|             | ( | A. | Careers in food service                   |
|             | ( | 1. | Careers in the food industry              |
| 2 – 4 Weeks | ( | B. | New technologies in food science          |
|             | ( | 1. | Research in the food industry             |
|             | ( | 2. | Food science experiments                  |
|             | ( | 3. | Developing new food products              |

<p style="text-align: center;"><b>CURRICULUM FRAMEWORK</b> <b>Food Science and Nutrition</b></p>
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**1. CONTENT STANDARD: EXPLORE THE WORLD OF FOOD AS A SCIENCE**

**1.01 COMPETENCY: Describe the scientific study of foods**

PERFORMANCE INDICATORS:

1. Explain food science and describe the main goal of food scientists
2. Explain the interrelationship of food science to other sciences
3. Explain the interrelationship of food science to nutrition

**1.02 COMPETENCY: Explain the basic concepts of nutrition**

PERFORMANCE INDICATORS:

1. Describe food sources, food nutrients and food groups
2. Explain the food guide pyramid
3. Describe the dietary needs of humans
4. Explain the purpose of the six main dietary nutrient groups
5. Explain the consequences of an unbalanced diet
6. Compare nutrient rich foods to nutrient poor foods

**1.03 COMPETENCY: Demonstrate methods and considerations required in the scientific evaluation of foods**

PERFORMANCE INDICATORS:

1. Explain the steps in the scientific method relative to food sciences
2. Identify the basic units of measurement: standard and metric
3. Explain areas, weight, volume, mass, and density
4. Explain the use of scientific equipment found in the food science laboratory
5. Explain the collection, organization and evaluation of data
6. Describe methods to analyze food mixtures, food microbiology, food fermentation, and food preservation
7. Describe equipment and methods used to measure, record, graph, and report food science experimental data
8. Demonstrate the proper use and care of scientific equipment
9. Explain safety guidelines in the laboratory
10. Write accurate and complete reports of food science experiments

## **2.0     CONTENT STANDARD: EXPLORE CHEMISTRY IN FOOD SCIENCE**

### **2.01    COMPETENCY: Explore chemistry as a science of matter**

#### PERFORMANCE INDICATORS:

1. Define matter and mass
2. Describe the six areas of study in chemistry and those related to food science
3. Explain chemical symbols
4. Interpret symbols, formulas, and equations
5. Explore methods of measuring mass
6. Describe the method of classification used in the scientific method
7. Describe the four physical states of matter
8. Compare pure substances to mixtures
9. Compare pure substances to elements and compounds
10. Compare heterogeneous mixtures to homogeneous mixtures
11. Compare the classification of compounds
12. Demonstrate means of determining pH
13. Demonstrate boiling point, freezing point, and volatility

### **2.02    COMPETENCY: Explore the structure of atoms, elements, and molecules**

#### PERFORMANCE INDICATORS:

1. Examine the structure of atoms and molecules
2. Compare elements, compounds, and mixtures
3. Compare extensive properties to intensive properties
4. Compare physical properties to chemical properties
5. Define a chemical reaction
6. Distinguish between the reactants and the products in a chemical reaction
7. Describe the transfer of energy in physical and chemical changes

### **2.03    COMPETENCY: Use the periodic table**

#### PERFORMANCE INDICATORS:

1. Describe the organization of the periodic table
2. Demonstrate locating names and symbols of elements on the periodic table
3. Explain how to locate metals, nonmetals, and metalloids
4. Explain Dalton's Atomic Theory
5. Define nucleus, electron, proton, and neutron
6. Explain the relationship between electron configuration and the arrangement of elements in groups, blocks, and periods
7. Calculate atomic number
8. Calculate mass number
9. Define isotope
10. Explain superscript and subscript information in the nuclear symbol
11. Define mole
12. Explain *Avogadro's Number*
13. Explain the concept of molar mass
14. Identify elements commonly found in foods

**2.04 COMPETENCY: Explore the formation of compounds through chemical bonding in foods**

PERFORMANCE INDICATORS:

1. Explain chemical bonding
2. Compare ionic bonding with covalent bonding
3. Explain electro-negativity differences to chemical bonding
4. Describe chemical stability
5. Describe the effect of chemical bonding on the physical properties of compounds commonly found in food

**2.05 COMPETENCY: Explore reactions of chemicals commonly found in food**

PERFORMANCE INDICATORS:

1. Describe various types of chemical reactions as they pertain to food
2. Illustrate the effect of a chemical reaction with an equation
3. Demonstrate examples of chemical reactions as they pertain to food

**2.06 COMPETENCY: Explore current theories about atomic structure, energy levels, sublevels, and orbitals**

PERFORMANCE INDICATORS:

1. Review the evolution of atomic theory
2. Describe emissions spectra of atomic electron configurations
3. Describe examples of energy sublevels and orbitals in the atoms of elements commonly found in food

**3. CONTENT STANDARD: EXPLORE THE APPLICATION OF FOOD SCIENCE AND NUTRITION**

**3.01 COMPETENCY: Explore the sensory evaluation of food**

PERFORMANCE INDICATORS:

1. Describe factors affecting individual food preferences
2. Explain sensory characteristics of food
3. Describe the effects of physical and chemical changes in foods
4. Analyze the properties of acids and bases
5. Describe ways that pH is related to food properties, safety, and freshness
6. Explain the importance of pH in digestion
7. Determine the pH of common foods
8. Describe how food sensory evaluations are conducted
9. Conduct and report the results of a food sensory evaluation

**3.02 COMPETENCY: Describe the physical and chemical characteristics of energy and their relationship to foods**

PERFORMANCE INDICATORS:

1. Define energy
2. Compare physical changes to chemical reactions
3. Relate molecular motion to temperature
4. Describe how heat is transferred
5. Compare heat of fusion to heat of vaporization
6. Define phase change
7. Describe the relationship between food intake and body weight
8. Describe how the human body uses energy derived from food components

**3.03 COMPETENCY: Describe the properties of water and their importance to the human body and food preparation**

PERFORMANCE INDICATORS:

1. Describe the chemical composition of water
2. Describe hydrogen bonds and how they differ from covalent bonds
3. Compare hard water to soft water
4. Describe the functions of water in food preparation
5. Explain the functions of water in the body

**3.04 COMPETENCY: Explore the sources and uses of carbohydrates in food science**

PERFORMANCE INDICATORS:

1. Identify the chemical structure of simple and complex carbohydrates
2. Explain the functions of sugar, starch, and pectin in food systems
3. Identify sources of carbohydrates
4. Explore the uses of carbohydrates in food preparation
5. Explain the effects of carbohydrates on metabolism and the human body

**3.05 COMPETENCY: Explain the effects of lipids in food science**

PERFORMANCE INDICATORS:

1. Define lipid
2. Describe the properties of lipids
3. Compare the properties of saturated and unsaturated fatty acids
4. Describe the functions of fat in the body
5. Explain the functions of fat in food preparation
6. Explain the relationship of fats to health issues

**3.06 COMPETENCY: Explore the sources, chemical changes, and importance of proteins in food science**

PERFORMANCE INDICATORS:

1. Define protein
2. Distinguish between the three types of proteins
3. Identify chemical elements that are common to all proteins
4. Describe the chemical structure of amino acids
5. Explain the denaturation of protein and how the process occurs
6. Describe how protein is used in food preparation
7. Describe the composition of eggs, egg storage and cooking
8. Explain the functions of protein in the body
9. Compare and contrast complete and incomplete protein

**3.07 COMPETENCY: Explain the importance of vitamins and minerals in food science**

PERFORMANCE INDICATORS:

1. Define vitamin
2. Explain the major categories of vitamins and their food sources
3. Distinguish between water-soluble and fat-soluble vitamins
4. Describe the major functions of vitamins and vitamin groups
5. Define mineral
6. Identify the chemical elements that make up minerals required for human health and nutrition
7. Distinguish between major and trace minerals and list examples in each category
8. Describe the food sources of minerals
9. Explain the consequences of vitamin and mineral deficiencies and excesses
10. Explain interrelationships among nutrients
11. Explore the effects of heat, light, and pH on the stability of vitamins and minerals

**3.08 COMPETENCY: Explore the processes of metabolism**

PERFORMANCE INDICATORS:

1. Define metabolism
2. Describe metabolism in terms of anabolism and catabolism
3. Describe the conditions needed for the process of metabolism
4. Explain basal metabolism
5. Explain how voluntary activities affect the need for kilocalories
6. Describe factors that affect metabolic changes to the human body
7. Explain why lactic acid builds up in muscles during various activities

**4. CONTENT STANDARD: DEMONSTRATE CHEMICAL PROCESSES INVOLVED IN FOOD PREPARATION**

**4.01 COMPETENCY: Explore the affects of enzyme reactions on food**

PERFORMANCE INDICATORS:

1. Define enzyme
2. Define substrate
3. Explain the relationship of an enzyme to a substrate
4. Compare enzyme and coenzyme
5. Describe factors that affect enzyme activity in the process of digestion
6. Describe the uses of enzymes in food preparation
7. Demonstrate the effects of enzymes in food preparation

**4.02 COMPETENCY: Examine the chemical properties and uses of solutions, colloidal dispersions, and emulsions in food preparation**

PERFORMANCE INDICATORS:

1. Define solution
2. Identify solvent and solute in a solution
3. Examine the properties of colloidal dispersions
4. Define emulsifier
5. Identify examples of gels, foams and emulsions
6. Describe the uses of gels, foams and emulsions in food preparation
7. Compare dispersed phase to continuous phase
8. Describe three parts of an emulsion
9. Examine various food emulsions
10. Calculate a solution concentration
11. Describe the process of homogenization
12. Compare a saturated solution to a solution that is unsaturated or super-saturated

**4.03 COMPETENCY: Demonstrate the chemical processes involved in leavening**

PERFORMANCE INDICATORS:

1. Define leavening agent
2. Describe four major leavening agents and their properties
3. Demonstrate how air and steam operate as leavening agents
4. Describe the properties of yeast as a leavening agent
5. Demonstrate the difference between quick breads and yeast breads
6. Explain the chemical reactions in the leavening process
7. Compare the effects of chemical and natural leavening agents on baked products

**4.04 COMPETENCY: Demonstrate the process of fermentation as it applies to the science of food**

PERFORMANCE INDICATORS:

1. Describe the process of cell respiration
2. Distinguish between aerobic and anaerobic respiration
3. Explain three reasons for fermenting foods
4. Describe three types of bacteria that are involved in food fermentation
5. Explain the role molds and enzymes play in fermentation
6. Distinguish between indigenous bacteria and non-indigenous bacteria
7. Demonstrate the purpose of lactobacillus in the process of fermentation
8. Demonstrate the scientific method in an experiment involving fermentation

**4.05 COMPETENCY: Explore the importance and uses of the milk food group in food science**

PERFORMANCE INDICATORS:

1. Describe the chemical composition of milk
2. Demonstrate the process of creaming
3. Distinguish between various milk products
4. Describe the chemical changes in milk as it is heated
5. Explain pasteurization
6. Explain milk coagulation
7. Demonstrate the scientific method in an experiment related to coagulating milk

**5. CONTENT STANDARD: EXAMINE MICROBIOLOGY IN FOOD PROCESSING AND PREPARATION**

**5.01 COMPETENCY: Explain the causes of food-borne illnesses and procedures for prevention**

**PERFORMANCE INDICATORS:**

1. Describe the types of micro-organisms
2. Explain the consequences of failure to maintain food safety and food quality
3. Describe the role of micro-organisms in food contamination and spoilage
4. Describe the environment required by various micro-organisms involved in food contamination
5. Define toxin, pathogen, and parasite
6. Explain food infection, food intoxication, and toxicoinfections
7. Describe common food-borne illnesses that are associated with improper handling, storage, and processing
8. Differentiate between cleaning and sanitizing
9. Demonstrate procedures used to prevent food-borne illnesses
10. Describe the role of government and agencies in promoting food safety
11. Demonstrate the scientific method in an experiment related to food contamination/food safety

**5.02 COMPETENCY: Demonstrate the purpose and procedures for food freezing, dehydration, and re-hydration**

**PERFORMANCE INDICATORS:**

1. Explain why fermentations preserve foods
2. Explain the purposes of dehydration
3. Compare the equipment used in home and commercial dehydration processes
4. Compare the nutritional value of dehydrated foods to fresh foods
5. Explain pre-treating food before dehydration
6. Illustrate four different methods of dehydration
7. Demonstrate methods for storing dehydrated food products
8. Explain re-hydration
9. Explore the role of blanching in freezing vegetables
10. Explore factors that affect the storage of frozen foods

**5.03 COMPETENCY: Demonstrate the purpose and safe procedures for canning**

**PERFORMANCE INDICATORS:**

1. Explain the purpose of canning
2. Distinguish between the different methods of canning
3. Compare the equipment used in commercial canning to home canning
4. Compare the nutritional value of canned foods to fresh foods
5. Describe safe food handling during canning
6. Demonstrate the scientific method in an experiment related to destroying bacteria during the canning process

#### **5.04 COMPETENCY: Examine food additives**

##### PERFORMANCE INDICATORS:

1. Define food additives and preservatives
2. Describe advantages and disadvantages of using food additives and preservatives
3. Describe the process of food irradiation and its effects on food
4. Explain the purpose of the Pure Food and Drug laws
5. Explain the purpose of the GRAS list
6. Explore sources of information on food additives
7. Demonstrate the scientific method in a sensory evaluation of foods with and without food additives

**6. CONTENT STANDARD: EXPLORE CAREER, TECHNOLOGY, AND CONSUMER EDUCATION IN FOOD SCIENCE AND NUTRITION**

**6.01 COMPETENCY: Analyze career paths in food science and nutrition**

PERFORMANCE INDICATORS:

1. Explore the employment and career opportunities associated with food science and nutrition
2. Explore emerging careers in food science and biotechnology
3. Identify entry level, technical level, and professional level careers in food science and nutrition
4. Describe the transferable skills that support employment and careers in food science and nutrition
5. Explore education and training required for careers in food science and nutrition
6. Describe additional career paths open to individuals with post-secondary degrees in food science and nutrition

**6.02 COMPETENCY: Explore emerging trends, research, and the impact of technology on the food science and nutrition industry**

PERFORMANCE INDICATORS:

1. Describe the benefits of various technological advances on the scientific study, processing, and preparation of food products
2. Describe examples of emerging technologies that may impact the food science and nutrition industry and careers
3. Explore food science and nutrition industry efforts to use resources more effectively
4. Explore new types of food products
5. Explore reengineered food products
6. Examine food packaging technology

**6.03 COMPETENCY: Examine consumer education issues in food science and nutrition**

PERFORMANCE INDICATORS:

1. Describe food labels and their value to consumers
2. Explore the effective use of resources in providing for nutritional needs of individuals
3. Evaluate advertising for food products, health foods, and supplements
4. Investigate facts and fallacies regarding food products and supplements